Revised 05/05

CORRES. CONTROL
INCOMING LTR NO.

0040c0 RF 05

DUE DATE

ACTION
00366-RF-05

DIST.	LTR	ENC
BERARDINI, J.H.	X	X
BOGNAR, E.S.	X	X
BROOKS, L.	X	X
CARPENTER, M.	X	X
CIUCCI, J.A.		
CROCKETT, G. A.	X	X
DECK, C. A.	X	X
DEGENHART, K. R.	X	X
DEL VECCHIO, D.		
FERRERA, D. W.	X	X
GIACOMINI, J. J.		
GILPIN, H.		
LINDSAY, D. C.	X	X
LONG, J. W.		
NESTA, S.		
SHELTON, D. C.	X	X
TUOR, N. R.	X	X
WARD, D.	X	X
WIEMELT, K.	X	X
ZAHM, C.	X	X
COR. CONTROL	X	X
ADMIN. RECORD	X	X

Reviewed for Addressee
Corres. Control RFP

7/13/05 dc
Date By

Ref. Ltr. #

DOE ORDER #
5400.1

1/52

RECEIVED

2005 JUL 13 P 4:03

CORRESPONDENCE CONTROL

Department of Energy

ROCKY FLATS PROJECT OFFICE
12101 AIRPORT WAY, UNIT A
BROOMFIELD, COLORADO 80021-2583

JUN 28 2005

05-DOE-00389

Ms. Carol Rushin
Office of Enforcement, Compliance and Environmental Justice
U.S. Environmental Protection Agency, Region VIII
999 18th Street, Suite 300
Denver, Colorado 80202

Mr. Arch Crouse
Colorado Department of Public Health and Environment
Air Pollution Control Division, SSP-B1
4300 cherry Creek Drive South
Denver, Colorado 80246-1530

Dear Ms. Rushin and Mr. Crouse,

Enclosed is the Rocky Flats Environmental Technology Site (Site) Calendar Year 2004 Radionuclide Air Emissions Annual Report, as required by Title 40, Code of Federal Regulations, Part 61, Subpart H (Subpart H), and Air Operating Permit #960PJE124 Section II.6.3. The Site was in compliance with the Subpart H standard as implemented through the Permit requirements for 2004.

If you have any questions concerning this report, please contact Bob Birk of my staff at (303) 966-5921.

Sincerely,

Frazer R. Lockhart
Manager

Enclosure

cc w/Enc:
G. Vasquez, EH-412
R. Anderson, EPA
R. Birk, HQPM
D. Shelton, KH
Admin Record

cc w/o Enc:
M. Aguilar, EPA
S. Gunderson, CDPHE
M. Putney, URS

RECEIVED
JUL 14 2005

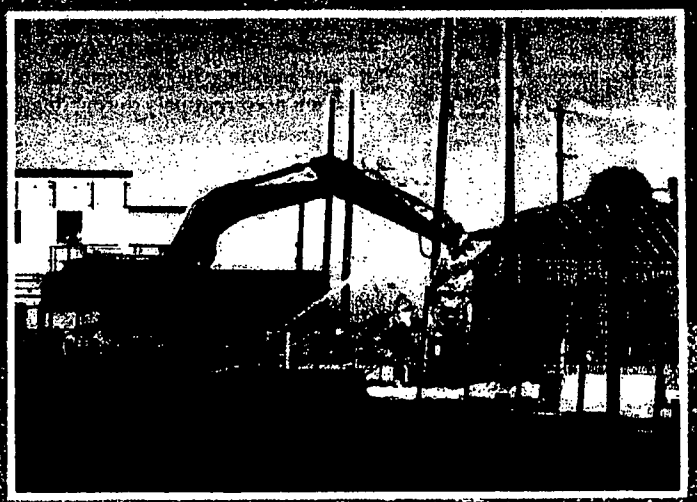
ADMIN RECORD

SW-A-005106

US Department of Energy

Radionuclide Air Emissions Annual Report Calendar Year 2004

Rocky Flats Environmental Technology Site



2

COVER

Background Photograph

The Building 771 stack stands tall against the Rocky Mountains in May 2004, partially obscured by the rubble of previous building demolitions. In the foreground, a barren, partially graded area marks the spot where Building 991 once stood.

Building 771, from the northwest, in 1969

Building 771, built in 1951, was one of the four original major buildings constructed at the Rocky Flats Plant (now the Rocky Flats Environmental Technology Site, RFETS). It initially served as the primary facility for plutonium operations, later specializing in plutonium recovery. Americium extracted from the plutonium was vended commercially for a number of years to be used in smoke detectors and other devices.

The Building 771 stack was razed on June 4, 2004 and building demolition was completed in October 2004.

Building 991, constructed between 1951 and 1952, was the first major building to be completed at the plant. Building 991 was designed for shipping, receiving, and storage, as well as for final assembly of weapons components. Three tunnels, portions of which can be seen in the cover photograph, led from Building 991 to underground storage vaults where nuclear weapons components were stored prior to shipment. Building 991 demolition was completed in May 2004.

Building 991, from the east, in 1991

Building 778, from the east, in 2000

Inset Photograph

Demolition of Building 778 in December 2004. Building 778, built in 1957, was a support building housing laundry facilities, showers, locker rooms, inert gas storage, and various shop operations. The long, thin rectangular building was located near the center of the "Protected Area" of the plant, and was connected to Buildings 776/777 and Building 707 by corridors. Water spray, as shown in the cover photograph, has been used routinely during demolition operations at RFETS to control fugitive dust emissions.

Radionuclide Air Emissions Annual Report for Calendar Year 2004

Prepared in accordance with
40 CFR 61, Subpart H
and
CAQCC Regulation No. 8, Part A, Subpart H

Site Name: Rocky Flats Environmental Technology Site

Operations Office Information

Office: Rocky Flats Project Office

Address: US Department of Energy
Rocky Flats Environmental Technology Site
10808 Hwy 93, Unit A
Golden, Colorado 80403-8200

Contact: Robert Birk Phone: (303) 966-5921

Site Information

Site Operator: Kaiser-Hill Company, LLC

Address: Rocky Flats Environmental Technology Site
10808 Hwy 93, Unit B
Golden, Colorado 80403-8200

Contact: Robert Nininger Phone: (303) 966-4663

Exempt from classification per CEX-105-01

EXECUTIVE SUMMARY

As required by Title 40 of the Code of Federal Regulations (CFR), Part 61, Subpart H, and Colorado Air Quality Control Commission Regulation No. 8, Part A, Subpart H, the airborne radiation dose to the public from the Rocky Flats Environmental Technology Site (Site) is determined annually and reported to the US Environmental Protection Agency and the Colorado Department of Public Health and Environment. These regulations limit the air pathway dose from Site activities to any member of the public to an annual effective dose equivalent (EDE) of 10 millirem (mrem). The Site was in compliance with the 10-mrem standard during 2004.

To provide context for the 10-mrem annual limitation, the average annual EDE for residents of the Denver area from all sources of radiation is approximately 420 mrem. Over 80% of this average annual EDE is due to natural background radiation (Roberts, 1998). The health risk associated with 1 mrem of EDE from naturally occurring sources of background radiation (such as uranium or thorium in rock or soil, cosmic rays, and radon emitted from soil or bedrock) is the same as that produced from anthropogenic sources of radiation (such as Site activities or medical x-rays).

Compliance with the 10-mrem standard was determined by comparing environmental radionuclide air concentration measurements at the critical receptor location with the "Concentration Levels for Environmental Compliance" listed in Table 2 of Appendix E to 40 CFR 61. Compliance is demonstrated when each measured radionuclide air concentration is less than its corresponding compliance level in Table 2 and when the fractional sum of all radionuclides is less than 1. For 2004, each measured radionuclide air concentration was less than 1% of the corresponding concentration level for environmental compliance and the fractional sum of all radionuclides was less than 2% of the allowable level at the sampler with the highest fractional sum (the critical receptor). The highest fractional sum measured in 2004 corresponds to an annual dose of 0.156 mrem or 1.56% of the 10-mrem standard.

As has been the case in previous years, airborne radionuclides appear to have been dominated by naturally occurring uranium isotopes in 2004. For example, at the critical receptor (the receptor having the maximum dose potential), uranium isotopes characteristic of naturally occurring uranium contributed more than 96% of the fractional sum. In addition, the location where the highest total radionuclide levels were measured in 2004 (north of the Site) was influenced by off-Site activities that generated dust (the sampler is located immediately adjacent to a dirt road that has seen increasing traffic volumes due to expanded commercial development in the Superior area). The dominance of apparently naturally occurring uranium isotopes combined with nearby fugitive dust sources is consistent with sampling results from 1997, 1998, 1999, 2000, 2001, 2002, and 2003.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

7

ABBREVIATIONS AND ACRONYMS

Am	Americium
ARAR	Applicable or Relevant and Appropriate Requirement
Bq	Becquerel(s)
CAP88-PC	Clean Air Act Assessment Package-1988
CAQCC	Colorado Air Quality Control Commission
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
Ci	Curie(s)
Ci/m^3	Curies per cubic meter
Ci/yr	Curies per year
cm	Centimeter(s)
cm^2	Square centimeter(s)
DOE	US Department Of Energy
dpm	Disintegrations per minute
DRCOG	Denver Regional Council of Governments
EDE	Effective dose equivalent
EIS	Effluent Information System
EPA	US Environmental Protection Agency
HEPA	High efficiency particulate air (filter)
km	Kilometer(s)
km^2	Square kilometer(s)
LM	[DOE] Office of Legacy Management
m	Meter(s)
m^2	Square meter(s)
m^3	Cubic meters(s)
mrem	Millirem(s)
m/s	Meters per second
mSv	MilliSievert(s)
N	Number of samples analyzed
ODIS	On-Site Discharge Information System
Pu	Plutonium
pCi/g	Picocuries per gram
RAAMP	Radioactive Ambient Air Monitoring Program
RCRA	Resource Conservation and Recovery Act
rem	Reference man
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RFPO	Rocky Flats Project Office
Site	Rocky Flats Environmental Technology Site
Sv	Sievert(s)
TRM	Transuranic mixed [waste]
TRU	Transuranic

U	Uranium
USC	United States Code
USFWS	US Fish and Wildlife Service
WIPP	Waste Isolation Pilot Plant
°C	Degrees Celsius
µCi	Microcurie(s)

1.0 INTRODUCTION

The Rocky Flats Environmental Technology Site (RFETS or Site) is subject to *National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities* (Title 40 of the Code of Federal Regulations [CFR], Part 61, Subpart H). Regulation 40 CFR 61, Subpart H, applies to operations at any facility owned or operated by the US Department of Energy (DOE) that emits radionuclides (other than radon-222 and radon-220) into the air. The standard requires that emissions of radionuclides to the ambient air from the Site not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent (EDE) of 10 millirem (mrem) (0.1 milliSieverts [mSv]). Colorado has incorporated 40 CFR 61, Subpart H, by reference as Colorado Air Quality Control Commission (CAQCC) Regulation No. 8, Part A, Subpart H.

Regulation 40 CFR 61, Subpart H, Section 61.94, requires the Site to demonstrate compliance with the standard for the previous calendar year and to submit this information, along with other data, to the US Environmental Protection Agency (EPA) in an annual report (CAQCC Regulation No. 8, Part A, Subpart H, requires submittal to the Colorado Department of Public Health and Environment [CDPHE]). This report fulfills the reporting requirements of 40 CFR 61.94 and CAQCC Regulation No. 8, Part A, Section 61.94, for the 2004 calendar year.

In 1997, DOE filed an application with EPA and CDPHE requesting approval of an alternative compliance demonstration method for 40 CFR 61, Subpart H (DOE, 1997). The alternative method is based on environmental measurements of radionuclide air concentrations at critical receptor locations, rather than the dispersion modeling approach outlined in the regulation itself. In cases where nonpoint sources of emissions are the primary contributors to dose, as has been the case at the Site since before 1995, such an alternative method based on environmental measurements is recommended by EPA (EPA, 1991).

The alternative compliance demonstration method was approved by CDPHE and EPA. The compliance sampling network, which consists of 14 samplers located around the perimeter of the Site, became fully operational in 1999. The samplers are part of the Site's Radioactive Ambient Air Monitoring Program (RAAMP) network. Compliance has been determined using the alternative method for this annual report.

RFETS is in the final year of closure and cleanup. Accelerated corrective and remedial actions are expected to be substantially complete by the end of 2005. Following completion of accelerated actions, administrative jurisdiction of most of the Site will be turned over to the US Department of the Interior, to be managed by the US Fish and Wildlife Service (USFWS) as a National Wildlife Refuge. The USFWS-managed portion of the former RFETS will no longer be subject to the requirements of 40 CFR 61, Subpart H. DOE will retain control over a much reduced portion of the original Site area containing low levels of soil or underground contamination that are infeasible to remove.

It is expected that the remaining DOE-controlled portion of RFETS will be governed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the final Corrective Action Decision/Record of Decision for the Site. At

this point, it is unclear whether 40 CFR 61, Subpart H will remain applicable to the remaining DOE-controlled property. If it is, the substantive requirements of the regulation would become Applicable or Relevant and Appropriate Requirements (ARARs), and the administrative requirements of 40 CFR 61, Subpart H may be waived. It is expected that any post-accelerated action requirements related to 40 CFR 61, Subpart H, will be discussed and finalized with CDPHE and EPA during 2005.

11

2.0 FACILITY INFORMATION

This section describes the Rocky Flats Environmental Technology Site, lists the radioactive materials present at the Site, and describes the handling and processing that the radioactive materials undergo. New construction or modifications in calendar year 2004 for which construction approval and startup notification were waived per 40 CFR 61.96 are also identified in this section. Construction approval and startup notification were not required for any new construction or modification in 2004.

2.1 Site Description

The Rocky Flats Environmental Technology Site is operated by Kaiser-Hill Company, LLC, with oversight by DOE's Rocky Flats Project Office (RFPO). Prior to 1989, the Site fabricated nuclear weapons components from plutonium, uranium, beryllium, and stainless steel. Production activities included metal fabrication and assembly, chemical recovery and purification of process-produced transuranic (TRU) radionuclides, and related quality control functions. Plutonium weapons operations were curtailed at the Site in 1989 due to safety concerns, and in February 1992, the Site's weapons production mission was discontinued.

In 2004, the Site's mission included decontamination and building demolition, waste management and shipment, environmental cleanup, and Site closure. Accelerated actions are targeted to be complete by the end of 2005. Following completion of the cleanup and closure of RFETS, DOE's Office of Environmental Management, which is responsible for the cleanup, will transfer management of the lands that DOE retains to DOE's Office of Legacy Management (LM). LM was established in December 2003 to conduct long-term management activities for DOE sites that no longer support DOE's ongoing missions, including disposal sites and other remediated sites such as RFETS. Following completion of all accelerated actions, the remainder of the Site will become a National Wildlife Refuge under the management of the USFWS.

The Site occupies an area of 26.5 square kilometers (km^2) in northern Jefferson County, Colorado, about 25.7 kilometers (km) northwest of Denver. The Site is located at approximately 1,829 meters (m) above mean sea level on the eastern edge of a geological bench known locally as Rocky Flats. This bench, about 8.1 km wide in an east-west direction, flanks the eastern edge of the Rocky Mountains.

Over 3 million people live within 80 km of the Site. Adjacent land use is a mixture of agriculture, open space, industry, and residential housing. Surrounding communities include the city of Golden to the south of the Site; the cities of Arvada, Broomfield, and Westminster to the east; and the cities of Boulder and Superior to the north. An area map is shown in Figure 2-1.

The former production facilities are located near the center of the Site. The remaining Site area historically contained support facilities and served as a buffer zone for former production facilities. As of September 2004, approximately 530 of the Site's 805 buildings and structures had been demolished. A simplified map of the Site is shown in Figure 2-2.

12

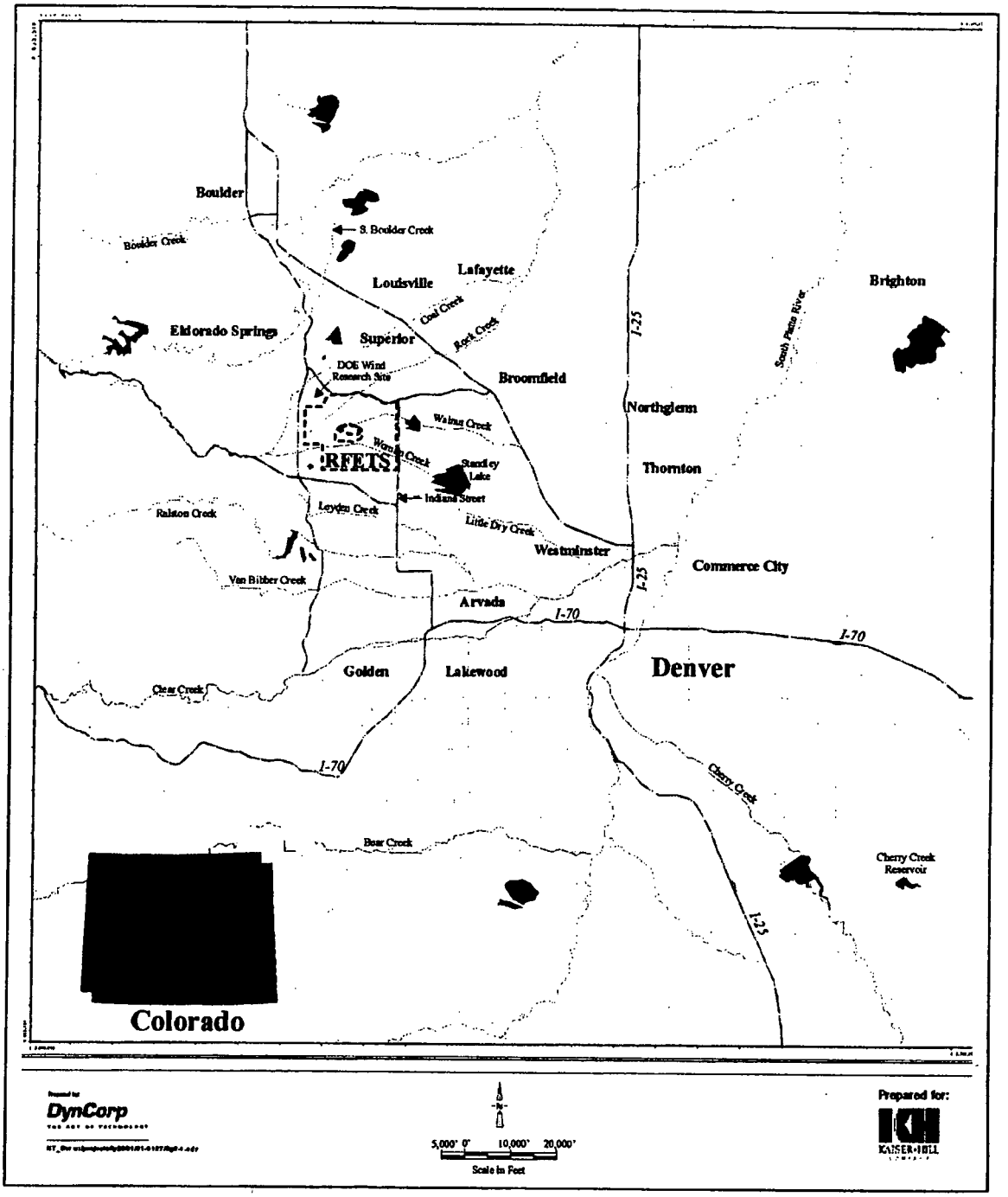


Figure 2-1. Area Map of the Rocky Flats Environmental Technology Site and Surrounding Communities

13

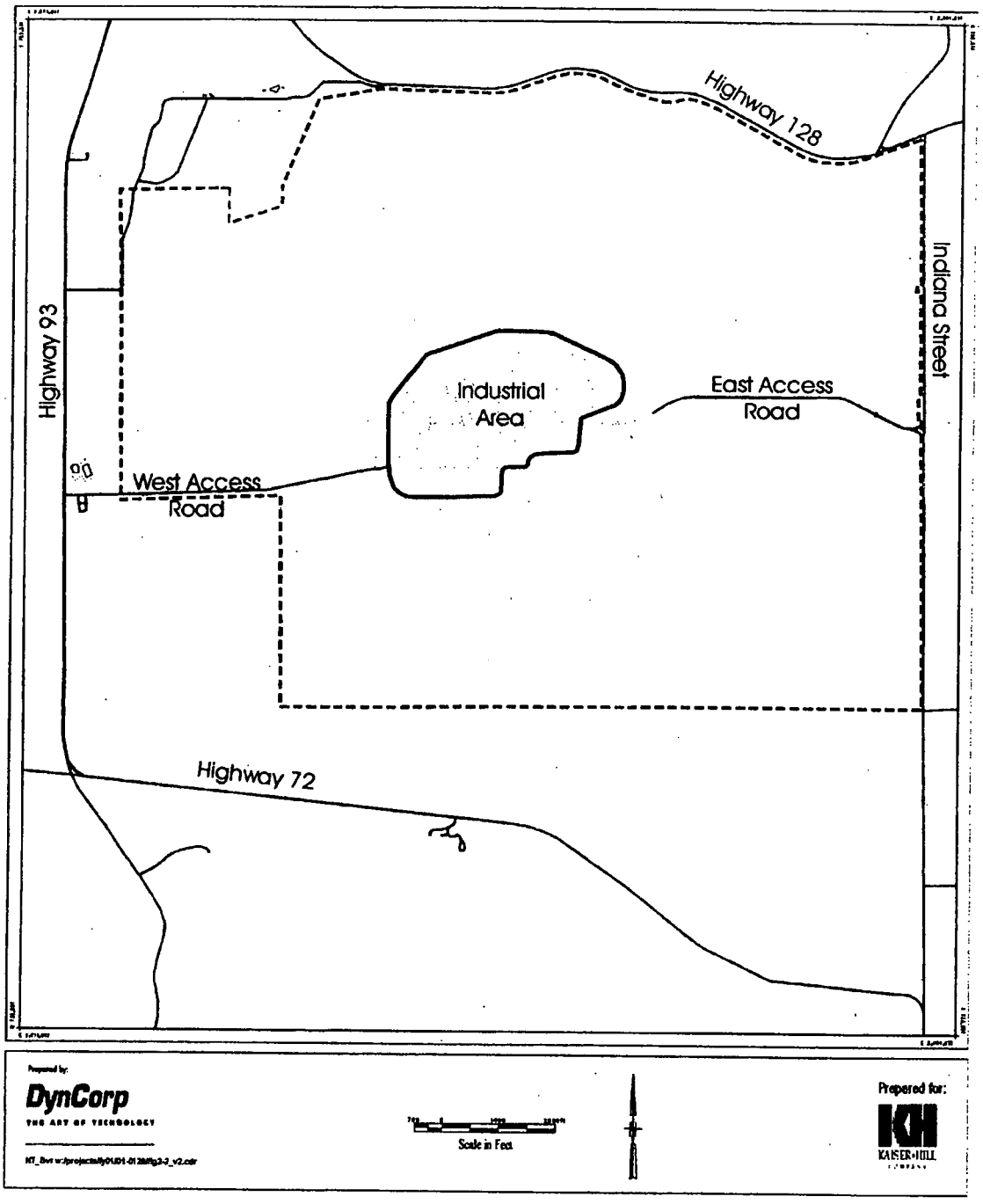


Figure 2-2. Rocky Flats Environmental Technology Site Location Map

14

2.2 Radionuclide Air Emissions Source Description

Activities involving radioactive material handling at the Site during 2004 focused on environmental restoration, building decommissioning and demolition, waste processing, and shipping support. Most of the radionuclide air emissions from the Site resulted from nonpoint (diffuse) sources, including mechanical and natural disturbances of contaminated soil and debris. Soil contamination was caused by past radioactive material spills and other releases. In addition, the soils on and around the Site contain small quantities of naturally occurring radionuclides. Decommissioning and demolition of former processing buildings also contributed to diffuse radionuclide emissions.

Past weapons-related activities in Site buildings resulted in residual radioactive material being deposited in Site ventilation systems and associated equipment such as gloveboxes. During 2004, some of this residual material was resuspended and released through building stacks or vents (point sources). However, few point sources of emissions remained at the Site in 2004 since most of the buildings have either been decommissioned and demolished, or have entered active decommissioning, an activity characterized by unpredictable variability in effluent flows as ductwork and plenums are decommissioned. In addition, where radioactive material was emitted from point sources, the effluent was generally cleaned prior to release by passing it through multiple stages of high efficiency particulate air (HEPA) filters. As a result, radionuclide point source emissions from the Site were very low in 2004.

2.2.1 Radioactive Materials Handling During Calendar Year 2004

In 2004, radionuclide emissions from the Site occurred from several activities that either disturbed resident contamination in buildings or in soil, or that processed or used radionuclide-containing substances such that emissions to the atmosphere resulted. Appendix A lists radioactive materials associated with the Site. The list of radionuclides includes plutonium (Pu)-239/240, americium (Am)-241, uranium (U)-233/234, U-235, and U-238. The Site also retains small quantities of beta- and gamma-emitting sealed sources and low activity analytical stock solutions, powders, and plated sources; emissions from these sources were negligible.

The major sources of Site radionuclide emissions in calendar year 2004 are described below.

Hold-up in Ducts

Radionuclide emissions were generated through disturbance of radionuclide-contaminated dust and other deposits on the surfaces of ventilation ducts exiting former process areas. Routine air movement and pressure changes in the ducts entrain a small amount of this contamination on an ongoing basis. In addition, decontamination and equipment removal or reconfiguration activities disturbed hold-up in certain ducts in 2004, resulting in additional emissions to the atmosphere. Ducts containing hold-up were vented through multiple stages of HEPA filters.

Resident Contamination

In some former process areas, contamination may be found on glovebox surfaces and floors, and, in limited cases, in the rooms themselves. As with hold-up, resident contamination was emitted in 2004 due to routine exposure to ventilation air and due to active disturbance by project activities, particularly decontamination and equipment movement. Ducts venting areas with significant contamination were exhausted through multiple stages of HEPA filters.

Waste Handling

Most of the low-level and TRU waste materials at the Site were generated during plutonium weapons component production and radionuclide recovery operations conducted prior to 1989. In 2004, solid waste, including contaminated gloveboxes and duct work, was segregated and size-reduced prior to packaging for storage and disposal. Such activities disturbed the radioactive contamination in the waste, resulting in radioactive particles in the room air.

Radioactive wastes were handled (segregated, size-reduced, and packaged) inside buildings or other structures. Venting the air through HEPA filters controlled emissions from these operations.

In addition to solid waste, liquid waste in tanks and pipes may also release radionuclides to the atmosphere, either through routine passive venting, or when liquid waste is exposed to the atmosphere when systems are drained or the materials treated. In addition to routine emissions from tank vents, liquid radioactive waste movement projects contributed to emissions during 2004. These activities took place in areas that vented through HEPA filters.

Waste Storage

Packaged low-level and TRU wastes are stored in drums at various locations on Site prior to shipping. Drums are vented to prevent pressure buildup from hydrogen gas, which is generated by radiolytic activity affecting packaged materials. Radionuclide emissions would only occur from these drums during venting if the inner packaging failed. To minimize emissions should the inner packaging fail, the drums are equipped with small filter cartridges that function like HEPA filters. For purposes of estimating emission potential for compliance with 40 CFR 61, Subpart H, the packaged materials inside these drums are considered sealed sources (in accordance with Appendix D to 40 CFR 61).

Waste Repackaging

Radionuclide emissions were generated in 2004 from waste characterization and repackaging activities that support waste shipment activities. Various radionuclide-contaminated wastes and residues were characterized and repackaged in preparation for shipment to the Nevada Test Site, Savannah River Site, the Waste Isolation Pilot Plant (WIPP), or other off-Site facilities. Most of the waste repackaging activities that occurred in 2004 took place in areas that were vented through HEPA filters.

16

Building/Structure Demolition Projects

Demolition projects at the Site are performed in accordance with the Rocky Flats Cleanup Agreement (RFCA). RFCA is a negotiated, interagency agreement governing CERCLA and Resource Conservation and Recovery Act (RCRA) cleanup activities at the Site. RFCA states that all unneeded buildings at the Site will be demolished. In most cases, contaminated systems are decontaminated and removed prior to demolition.

The following structures were demolished in 2004:

- Buildings 443, 223, 991, 952, 128, 131, 130, 774, 771, 715, 717, 710, 127, 881 Cluster, 705, 706, 903 A-A3, 124, 129, 447, 448, 451, 750, 121, 122, 964, 115, 883 Annex, 879, 903B, 883 C-side, 995, 664, 906, 528, 302, 562, 564, and 708.
- Trailers 371A–F, 119B&C, 771A-C, 771G, 771L, 124A, 303D, 706A, 779A, 707B, 115B, 891B-C, 891T, 664A, and 130I.

Miscellaneous Point Sources

No new point sources were initiated in 2004. Miscellaneous point source operations that continued from previous years included a drum crushing activity at the 750 Pad, Tent 5, which operated intermittently during 2004; the Trailer 130A laboratory; 750 Pad, Tent 5 TRU-mixed (TRM) waste sludge, low level waste, and low level mixed waste repackaging, and waste chemical repackaging at the 750 Pad, Tent 5.

Miscellaneous Nonpoint Sources

Another contributor to Site radionuclide emissions in 2004 was the resuspension of contaminated particulates. Contaminated soils were resuspended by wind erosion, vehicle traffic, and other mechanical soil disturbances. Miscellaneous nonpoint sources that emitted radionuclides in 2004 included the 903 Lip Area remediation (continued from 2003), IHSS Group 700-7 remediation, B-series ponds remediation, Bowman's Pond remediation, IHSS 118.1 remediation, Building 443 area culvert removal, radiological "hotspot" removal at the Original Landfill, tanker loading at the 750 Pad, repackaging of Building 374 sludge at the 750 Pad, and demolition of Buildings 771/774, 447, 964, 883 Annex, and 883 C-side. Emissions generated by wind erosion were uncontrolled, while radionuclide emissions from vehicle traffic and mechanical disturbances were sometimes controlled using dust suppression techniques.

2.2.2 New Construction and Modifications in Calendar Year 2004

Fifteen new or modified activities that contributed to the Site air pathway dose in calendar year 2004 are described below. As part of the project evaluation process (prior to the startup of each project), the maximum annual (controlled) off-Site EDE that could result from each new or modified activity was calculated to determine approval and notification requirements. Maximum potential radionuclide emissions were estimated using emission and control factors from Appendix D to 40 CFR 61, combined with information regarding radionuclide contaminant levels and material forms, radionuclide release mechanisms, and the radionuclide emission controls employed. In cases where HEPA filters were employed, credit was taken for a maximum of two stages, although up

17

to four stages may actually have been employed. Emissions were modeled using the Clean Air Act Assessment Package-1988 (CAP88-PC), and recent Site meteorological data to estimate annual EDEs at the most impacted off-Site residence and business locations.

To place the reported EDE values in context, it should be noted that the emission estimation and modeling methods used in this exercise are designed to generate "worst case" dose estimates. The emission factors, control device efficiencies, and modeling approach are mandated by 40 CFR 61, Appendix D, to ensure that project dose will not be underestimated when determining whether notification and approval are necessary under the regulation. In fact, actual emissions and dose will often be much lower than the estimates used to determine approval and notification requirements.

Detailed data and calculations used to develop emission estimates and resulting dose projections are maintained in Site files. The estimated EDE (shown below) for each new construction or modification was less than 1% of the 10-mrem (0.1-mSv) standard, and construction approval and startup notification were unnecessary under 40 CFR 61.96.

The project- or process-specific EDEs used in making regulatory applicability decisions regarding approval requirements are discussed below.

Modified 750 Pad, Tent 5 Repackaging of Low-level/Low-level Mixed Waste: In 2004, the low-level/low-level mixed waste repackaging process in Tent 5 on the 750 Pad was modified to include TRM and TRU waste. One hundred eight drums of TRM and TRU waste were transported to Tent 5, characterized, sorted, and repackaged to bring them into compliance. The repackaged containers were then stored for eventual shipment to an approved off-Site disposal facility.

Negative air pressure was maintained within the repackaging containment structures, which exhausted through at least one stage of HEPA filters. Dose calculations for this project were based on the assumptions that all TRM and TRU drums had the mean measured plutonium content for all drums, that all contents of each drum would be exposed and could become airborne, that the process would operate at its maximum design rate, and on emission factors from 40 CFR 61, Appendix D. The maximum annual (controlled) off-Site EDE for this project was estimated to be 6.8×10^{-6} mrem (6.8×10^{-8} mSv).

Low-Level Building 374 Sludge Repackaging at the 750 Pad: Building 374 sludge was repackaged at the 750 Pad, just north of Tent 2, in 2004. Three intermodals of Building 374 sludge had radiological activities that prohibited shipment. The three intermodals were repackaged at the 750 Pad to ensure a final waste form and package that allowed shipment to Envirocare of Utah.

The EDE estimation used the volume and measured radiological activity from each intermodal, and emission factors from 40 CFR 61, Appendix D. The maximum annual off-Site EDE from the project was estimated to be 2.0×10^{-4} mrem (2.0×10^{-6} mSv).

Tanker Loading at the 750 Pad: In 2004, 10,000 gallons of low-level mixed organic waste from various sized drums were transferred to a tanker trailer. The transfer was

conducted using positive pressure liquid transfer through a hose in a cargo container at the 750 Pad on the south side of the boundary fence.

The EDE estimation used the total volume, estimated radiological activity, and an emission factor from 40 CFR 61, Appendix D. The maximum annual off-Site EDE from the project was estimated to be 2.7×10^{-5} mrem (2.7×10^{-7} mSv).

Building 774, Rooms 202, 203, and 210 Demolition: In 2004, Rooms 202, 203, and 210 in Building 774 were demolished. The rooms did not meet free release criteria for radionuclide contamination. The entire inside surface area of the rooms was assumed to be contaminated at the mean detected levels from radiological survey data.

The EDE estimation used the demolition release rate approved in the peer reviewed *Building 776/777 Air Modeling Technical Document* (Kaiser-Hill, 2002), the total inside area of the rooms to be demolished, and mean radionuclide contamination levels from data summaries. The maximum annual off-Site EDE from the project was estimated to be 9.6×10^{-7} mrem (9.6×10^{-9} mSv).

Building 447 Demolition: Building 447 was demolished in 2004. The building did not meet free release criteria for radionuclide contamination. Total depleted uranium activity present when the building was demolished was estimated to be 2.54×10^{4} grams.

The EDE estimation used the total estimated depleted uranium activity, and the demolition release rate approved in the peer reviewed *Building 776/777 Air Modeling Technical Document* (Kaiser-Hill, 2002). The maximum annual off-Site EDE from the project was estimated to be 6.5×10^{-6} mrem (6.5×10^{-8} mSv).

Building 771 Demolition: Building 771 was demolished in 2004. The building did not meet free release criteria for radionuclide contamination. Total plutonium activity present when the building was demolished was estimated to be less than 1 gram.

The EDE estimation used the total estimated plutonium activity (1 gram), and the demolition release rate approved in the peer reviewed *Building 776/777 Air Modeling Technical Document* (Kaiser-Hill, 2002). The maximum annual off-Site EDE from the project was estimated to be 2.0×10^{-4} mrem (2.0×10^{-6} mSv).

Building 883 Annex Demolition: The Building 883 Annex was demolished in 2004. The building did not meet free release criteria for radionuclide contamination. Total depleted uranium activity present when the building was demolished was estimated to be 1.28×10^{4} grams.

The EDE estimation used the total estimated depleted uranium activity, and the demolition release rate approved in the peer reviewed *Building 776/777 Air Modeling Technical Document* (Kaiser-Hill, 2002) The maximum annual off-Site EDE from the project was estimated to be 6.2×10^{-6} mrem (6.2×10^{-8} mSv).

Building 883 C-Side Demolition: The Building 883 C-side was demolished in 2004. The building did not meet free release criteria for radionuclide contamination. Total depleted uranium activity present when the building was demolished was estimated to be 2.97×10^{3} grams.

The EDE estimation used the total estimated depleted uranium activity, and the demolition release rate approved in the peer reviewed *Building 776/777 Air Modeling Technical Document* (Kaiser-Hill, 2002) The maximum annual off-Site EDE from the project was estimated to be 1.6×10^{-6} mrem (1.6×10^{-8} mSv).

Building 964 Demolition: Building 964 was demolished in 2004. The building did not meet free release criteria for radionuclide contamination. The building slab contained approximately 50 cubic yards (38 cubic meters) of contaminated concrete. The concrete was assumed to be contaminated at the maximum value for low-level waste (100 nanocuries Pu per gram).

The EDE estimation used the total volume of contaminated concrete, maximum contamination levels for low-level waste, and used concrete size reduction emission factors from EPA's *Compilation of Air Pollutant Emission Factors*, AP-42 (EPA, 1995). The maximum annual off-Site EDE from the project was estimated to be 8.6×10^{-5} mrem (8.6×10^{-7} mSv).

IHSS Group 700-7 Remediation: IHSS Group 700-7 was remediated in 2004. This included contaminated concrete at the Building 779 slab, the Building 782 slab, and the Building 783 slab. It also included contaminated soil under the Building 779 slab. The total quantity of contaminated concrete and soil was assumed to be contaminated at the maximum detected value of 97,320 picocuries per gram (pCi/g) Pu-239.

The EDE estimation used the total volume of contaminated concrete and soil, maximum detected contamination levels, and emission factors from EPA's *Compilation of Air Pollutant Emission Factors*, AP-42 (EPA, 1995). The maximum annual off-Site EDE from the project was estimated to be 3.5×10^{-4} mrem (3.5×10^{-6} mSv).

IHSS 118.1 Remediation: IHSS 118.1 was remediated in 2004. Total contaminated soil was estimated to be 500 cubic yards (382 cubic meters). Maximum radionuclide contamination was measured at 0.2 pCi/g Pu-239 and 0.11 pCi/g Am-241.

The EDE estimation used the total volume of contaminated soil, maximum detected contamination levels, and emission factors from EPA's *Compilation of Air Pollutant Emission Factors*, AP-42 (EPA, 1995). The maximum annual off-Site EDE from the project was estimated to be 4.0×10^{-8} mrem (4.0×10^{-10} mSv).

Original Landfill Radiological Contamination Surface Soil Removal: In 2004, radiologically contaminated surface soil was removed from four locations at the Original Landfill. The total amount removed was approximately 75 cubic yards (57 cubic meters). Data indicated that the worst-case contamination was 2,800 pCi/g U-234; 670 pCi/g U-235; and 38,000 pCi/g U-238.

The EDE estimation used the total volume of contaminated soil, maximum detected contamination levels, and emission factors from EPA's *Compilation of Air Pollutant Emission Factors*, AP-42 (EPA, 1995). The maximum annual off-Site EDE from the project was estimated to be 8.1×10^{-5} mrem (8.1×10^{-7} mSv).

Bowman's Pond Remediation: Bowman's Pond was remediated in 2004. Approximately 28 cubic yards (21 cubic meters) of contaminated soil and 78 cubic yards (60 cubic meters) of concrete waste were removed. Data indicated that the worst-case

contamination was 1.47 pCi/g Am-241; 6.05 pCi/g Pu-239; 5.05 pCi/g U-234; 0.22 pCi/g U-235; and 8.12 pCi/g U-238.

The EDE estimation used the total volume of contaminated soil and concrete, maximum detected contamination levels, and emission factors from EPA's *Compilation of Air Pollutant Emission Factors*, AP-42 (EPA, 1995). The maximum annual off-Site EDE from the project was estimated to be 4.3×10^{-8} mrem (4.3×10^{-10} mSv).

B-Series Ponds Sediment Remediation: In 2004, contaminated sediments in the B-series Ponds were stabilized, removed, and stockpiled for future removal. Approximately 27,672 cubic yards (21,157 cubic meters) of stabilized contaminated sediment have been removed. Representative contamination levels were 53 pCi/g Am-241, and 285 pCi/g per gram Pu-239. This activity will continue into 2005.

The EDE estimation used the total volume of contaminated sediment, maximum detected contamination levels, and emission factors from EPA's *Compilation of Air Pollutant Emission Factors*, AP-42 (EPA, 1995). The maximum annual off-Site EDE from the project was estimated to be 4.1×10^{-3} mrem (4.1×10^{-5} mSv). Although emissions from this project will occur in both 2004 and 2005, the entire estimated dose from the project has been conservatively assigned to 2004 for this report.

Building 443 Culvert Removal: Selected culverts in the Building 443 area were removed in 2004. The soil covering and surrounding the culverts was potentially contaminated at low-level radiological levels. The total amount of potentially contaminated soil was estimated at 60 cubic yards (46 cubic meters).

The EDE estimation used the total volume of potentially contaminated soil, conservative contamination levels, and emission factors from EPA's *Compilation of Air Pollutant Emission Factors*, AP-42. The maximum annual off-Site EDE from the project was estimated to be 6.8×10^{-6} mrem (6.8×10^{-8} mSv).

2.1

3.0 AIR EMISSIONS DATA

This section discusses and quantifies radionuclide emissions from the Site for calendar year 2004. The stacks, vents, and other points where radioactive materials were released to the atmosphere are described, and control measures employed by the Site to minimize emissions are discussed.

3.1 Emission Determination Process

This section presents an estimate of Site radionuclide air emissions in calendar year 2004. Where air effluent exiting buildings through stacks or vents was continuously sampled and radionuclide emissions measured, those data are presented here. In most cases, however, emissions from activities that generated airborne radionuclides were not measured. Given the Site's cleanup and closure mission, it is not surprising that an increasing number of Site emission sources are not amenable to direct measurement methods. For these activities, emissions were estimated based on project-specific information, combined with emission factors from various sources. Emission sources that were clearly negligible were not quantified.

Where emissions were estimated, rather than directly measured, the emission estimates were based on:

- The radionuclide content of materials or debris handled or processed;
- The form of the radioactive material (gas, liquid, solid, or particulate; fixed or removable);
- The mechanisms by which radionuclides were released to the atmosphere;
- The time over which the activities that released radionuclides occurred or the time that the radioactive material was exposed to the atmosphere;
- The control measures employed to reduce radionuclide emissions; and
- Emission factors appropriate to a given activity.

Emission factors were derived from several sources. Radionuclide emission factors listed in Appendix D to 40 CFR 61 were used to calculate emissions due to exposure of radioactive material to the atmosphere during processing or handling. Additional emissions resulting from the release of radionuclide-contaminated particles through handling or processing soil and debris were based on emission factors in EPA's *Compilation of Air Pollutant Emission Factors,* AP-42 (EPA, 1995). The appropriate emission factors were combined with project- or process-specific information to yield estimated radionuclide emissions. In the case of several contaminated building demolitions, emission estimates were based on the demolition release rate approved in the *Building 776/777 Air Modeling Technical Document* (Kaiser-Hill, 2002).

In addition to emissions from specific projects or processes, an ongoing source of radionuclide emissions from the Site is the resuspension of contaminated surface soils by wind erosion. Emissions from this source were estimated by combining information regarding Site-wide surface soil concentrations of radionuclide contaminants with a Site-specific soil resuspension factor. Development of the resuspension factor was discussed

22

in detail in a previous annual report (DOE, 1996). Historical surface soil radionuclide data from a Site-specific soil sampling database provided the contaminant concentration data needed to complete the wind erosion emission calculations. Resuspension emissions have not been revised from earlier estimates to account for the decreased areas of surface soil contamination remaining on Site; therefore, the values presented here are very conservative relative to the current actual situation.

The emissions discussed in this section include all isotopes that have the potential to contribute 10% or more to the Site's total air pathway EDE. These include:

- Uranium isotopes typical of the depleted and enriched uranium that have been used at the Site, as well as uranium isotopes that are naturally present in Site soils;
- Pu-239/240, which contributes more than 97% of the alpha activity in Site plutonium; and
- Am-241, a decay product of Pu-241, which is a minor component of the weapons-grade plutonium that was used at the Site.

3.2 Point Sources

Radionuclide emissions released through stacks and vents are termed "point" sources. In 2004, radionuclide point source emissions at the Site included both measured releases from stacks and vents in the Industrial Area and releases that were estimated as described in Section 3.1. Point source emissions for calendar year 2004 and the control technology used at each point source are described in this section.

3.2.1 Measured Point Source Emissions

During calendar year 2004, radionuclide emissions were collected and measured only at significant release points. Significant release points are those that have the potential to discharge radionuclides into the air in quantities that would result in an annual EDE to the public greater than 1% of the 10-mrem standard, based on uncontrolled emissions (without considering HEPA filtration). Insignificant release points are those that have the potential to discharge radionuclides in lesser quantities. Unless it can be shown to be impractical for a given significant release point, significant release points must be continuously monitored or sampled, while insignificant release points require periodic confirmatory measurements to verify low emissions (40 CFR 61.93).

Prior to 1999, periodic confirmatory measurements to verify low emissions were made at insignificant release points using the effluent sampling systems described below. Effluent sampling was discontinued at insignificant locations in 1999 and 2000, and the compliance sampling network (an ambient air monitoring network that is described in Section 4.1.1) has been used since then to confirm low emissions.

In addition, sampling has been discontinued at most of the other former release points because they are undergoing active decommissioning, making it impractical to continue effluent monitoring, or because the buildings have been demolished. During active decommissioning, air flow through the ventilation systems is disturbed sufficiently that the measurement and quantification of radionuclide releases becomes unreliable and no longer representative, or the sampler locations themselves become compromised by

23

removal of necessary infrastructure. At that point, sampling locations undergoing active decommissioning are removed from service and any radioactive particulate matter release associated with such locations is accounted for through the compliance sampling network.

Effluent Sampling Methods

Point source emissions are measured at the Site with sampling systems that continuously draw a portion of the duct or vent airstream through a filter. Radioactive particles are collected on the filters, which are generally exchanged weekly. Following collection, the filters are screened for long-lived alpha and beta radiation to check for elevated radionuclide emissions.

Following alpha/beta screening, the samples are composited monthly by location and analyzed for plutonium, americium, and uranium isotopes. All radionuclides that could contribute greater than 10% of the potential EDE for a release point were measured during calendar year 2004.

Calendar Year 2004 Effluent Sampling

In calendar year 2004, particulate matter samples were collected at 12 air effluent sampling locations, representing six discrete release points (three of the sampling systems employed multiple probes and filters, which were then composited by release point). Only one location was sampled all year. Sampling was discontinued in late June 2004 at one sampling location and in early July 2004 at 10 additional sampling locations, representing five of the six release points. As of December 31, 2004, effluent sampling was limited to Building 440. The Building 440 sampling system is expected to be shut down in the second quarter of calendar year 2005, at which point effluent sampling will be permanently discontinued at RFETS. Appendix B lists the sampling locations monitored during 2004. Measured calendar year 2004 emissions of plutonium, americium, and uranium are shown in Table 3-1.

Appendix C shows calendar year 2004 measured point source emissions data, formatted to conform to DOE's Effluent Information System (EIS), a historical database for recording and reporting radioactive effluent data for airborne and waterborne discharges that travel off site from facilities under DOE control. DOE no longer requires its facilities to submit an EIS report.

3.2.2 Calculated Point Source Emissions

During 2004, several point sources operated at the Site that did not trigger continuous sampling requirements because they had low emission potential or were of short duration. Sources that continued operation from 2003 included several activities in Tent 5 at the 750 Pad, including a drum crusher, and repackaging of waste chemicals, low-level, and low-level mixed waste; repackaging of TRM waste at the 750 Pad; and the Trailer 130A laboratory. No new point sources were initiated in 2004. Point sources with calculated emissions that continued operation from 2003 are described below. Emissions were calculated for these insignificant release points as described in Section 3.1. Table 3-2 shows calculated point source emission estimates for calendar year 2004.

2-4

Table 3-1. Measured Point Source Radionuclide Emissions

Building/ Location[a]	Isotope Emissions (Ci/yr) [b,c,d]				
	Pu-239/240	Am-241	U-233/234	U-235	U-238
371-N01	3.39E-09	2.25E-09	2.04E-09	7.62E-10	1.48E-09
371-N02	7.73E-09	2.68E-09	6.25E-09	2.17E-09	2.56E-09
371-SSS	2.55E-09	6.52E-10	2.60E-09	2.76E-10	2.79E-09
374-MAI	8.39E-10	1.81E-09	3.83E-09	2.16E-09	4.88E-09
440-101	8.75E-10	3.64E-10	1.40E-09	7.84E-10	1.24E-09
559-561	1.34E-09	9.27E-10	6.78E-09	4.03E-09	4.02E-09

[a] The first number in this column designates the building cluster, the second set of characters designates the specific duct(s) or vent(s). The location of each release point is shown in Figure 3-1 of this report.

[b] Values were corrected for filter blanks.

[c] All measured point sources were controlled by HEPA filters with a tested control efficiency of at least 99.97 percent.

[d] All isotopes that could contribute greater than 10% of the potential EDE for a release point were measured.

Notes:

Am	=	Americium	Ci/yr	=	Curies per year, 1 Ci = 3.7 x 10^{10} Becquerel (Bq)
E#	=	x $10^{\#}$	EDE	=	Effective dose equivalent
HEPA	=	High efficiency particulate air	Pu	=	Plutonium
U	=	Uranium			

Table 3-2. Calculated Point Source Radionuclide Emissions

Activity or Building	Isotope Emissions (Ci/yr) [a]				
	Pu-239/ 240	Am-241	U-233/234	U-235	U-238
750 Pad, Tent 5 Drum Crusher[b]	4.7E-08	4.2E-09	--	--	--
Trailer 130A Laboratory[b]	1.1E-09	1.3E-10	--	--	--
750 Pad, Tent 5 TRM/TRU Repackaging[b]	2.4E-07	2.9E-08	--	--	--
750 Pad, Tent 5 Low-level and Low-level Mixed Waste Repackaging[b]	1.4E-07	1.6E-08	--	--	--
750 Pad, Tent 5 Waste Chemical Repackaging[b]	2.2E-06	2.3E-07	--	--	--

[a] Emissions of all isotopes that could contribute greater than 10% of the potential EDE for a release point were estimated. Isotopes for which emissions were not estimated are shown as "--". The locations of the release points listed are shown in Figure 3-1 of this report.

[b] HEPA filtration used with a control efficiency of at least 99.97 percent.

Notes:

Am	=	Americium	Ci/yr	=	Curies per year, 1 Ci = 3.7 x 10^{10} Becquerel (Bq)
E#	=	x $10^{\#}$	EDE	=	Effective dose equivalent
HEPA	=	High efficiency particulate air	Pu	=	Plutonium
U	=	Uranium	--	=	Not estimated/negligible

750 Pad, Tent 5 Drum Crusher: In 2000, a drum crusher was installed within the Tent 5 containment structure at the 750 Pad and has operated since that time. Operation of the drum crusher was initially limited to empty drums with contamination levels less than or equal to 20 disintegrations per minute (dpm) per 100 square centimeters (cm^2). The maximum process rate of the drum crusher was approximately 30 drums per hour. In 2001, the maximum contamination level of the drums was raised to 100,000 dpm/ 100 cm^2.

The containment structure air exhausted through a single-stage HEPA filter. For 2004, dose calculations were based on the conservative assumptions that the crusher would operate at the maximum process rate 24 hours per day, 5 days per week, 52 weeks per year and that each drum was contaminated at 100,000 dpm/100 cm^2 over the entire surface area. In fact, the drum crusher operated only intermittently during 2004, so the actual emissions would have been substantially less than estimated here.

Trailer 130A Laboratory: In 2004, Trailer 130A was used for radiological sample collection, receiving, packaging, and shipping, as well as gamma spectroscopy operations and low-level analytical services. Maximum process rates, and worst case scenario radiological activity, were taken from Appendix 2 of the "Auditable Safety Analysis" document for Building T130A (Kaiser-Hill, 2003).

Low-level sample work was performed in fume hoods, and high-level sample work was performed in gloveboxes that exhausted through at least one stage of HEPA filters. The off-Site EDE was calculated based on the maximum process rates, worst-case scenario radiological activity, and an emission factor from Appendix D to 40 CFR 61.

750 Pad, Tent 5 Repackaging of Waste Chemicals: In 2004, drums of legacy waste chemicals were repackaged in Tent 5 on the 750 Pad. The drums were evaluated, characterized, and repackaged for off-Site disposal, or returned to on-Site storage.

The repackaging operation exhausted through two stages of HEPA filters. Dose calculations for this project were based on the conservative assumption that all drums were at the maximum concentration for low-level waste (100 nanocuries plutonium per gram waste), on the assumption that there would be 20 drums open to the atmosphere at all times, and on emission factors from 40 CFR 61, Appendix D.

750 Pad, Tent 5 Repackaging of Low-level/Low-level Mixed Waste: In 2004, low-level/low-level mixed waste was repackaged in Tent 5 on the 750 Pad. Waste drums and boxes that were identified as non-compliant for off-Site disposal were transported to Tent 5, characterized, sorted, and repackaged to bring them into compliance. The repackaged containers were then stored for eventual shipment to an approved off-Site disposal facility.

Negative air pressure was maintained within the repackaging containment structures, and exhausted through at least one stage of HEPA filters. Dose calculations for this project were based on the conservative assumption that all waste forms were at the maximum concentration for low-level waste (100 nanocuries plutonium per gram waste), on the assumption that the process would operate at its maximum design rate, and on emission factors from 40 CFR 61, Appendix D.

96

750 Pad, Tent 5 Repackaging of TRM and TRU Waste: In 2004, the low-level/low-level mixed waste repackaging process in Tent 5 on the 750 Pad was modified to include TRM and TRU waste. One hundred eight drums of TRM and TRU waste were transported to Tent 5, characterized, sorted, and repackaged to bring them into compliance. The repackaged containers were then stored for eventual shipment to an approved off-Site disposal facility.

Negative air pressure was maintained within the repackaging containment structures, and exhausted through at least one stage of HEPA filters. Dose calculations for this project were based on the assumptions that all TRM and TRU drums had the mean measured plutonium content for all drums, that all contents of each drum would be exposed and could become airborne, on the assumption that the process would operate at its maximum design rate, and on emission factors from 40 CFR 61, Appendix D.

Unmonitored Building Stacks and Vents: Small amounts of radionuclides continued to be released from various building stacks and vents that have been classified as insignificant release points during at least a portion of 2004. Individually, none of these release points had the potential to release radionuclides in amounts that could result in an off-Site EDE in excess of 1% of the 10 mrem standard, even if the emissions were uncontrolled. Many of these release points were controlled by two or more stages of HEPA filters; consequently, actual emissions would have been a fraction of a percent of the standard limitation. As a result, no attempt has been made to estimate emissions from these sources; instead, the compliance sampling network data have been used to demonstrate that none of these points released significant quantities of radionuclides during calendar year 2004 (see Section 4.1 of this report).

3.2.3 Control Technology for Point Sources

HEPA filters are used to control radioactive particulate matter emissions from air effluent systems. All of the point source locations listed in Table 3-1 used HEPA filtration in 2004. Effluent air from areas where plutonium or plutonium-contaminated wastes were processed was typically cleaned by a minimum of four stages of HEPA filters. Effluent air from uranium processing areas was generally cleaned by a minimum of two stages of HEPA filters. HEPA filters were bench tested prior to installation in the buildings to ensure that they would meet a minimum filter efficiency of 99.97% (Novick, et al., 1985). Filter assemblies were tested again for leaks following installation.

The Trailer 130A laboratory operations, and the 750 Pad Tent 5 chemical repackaging, TRM sludge repackaging, low-level/low level mixed waste repackaging, and drum crusher operations were each controlled by a minimum of one HEPA filter.

3.3 Nonpoint Sources

Radionuclide emissions that are not released through specific stacks or vents are termed "nonpoint" (or diffuse) sources. Table 3-3 summarizes emissions from nonpoint sources for calendar year 2004.

Table 3-3. Nonpoint Source Radionuclide Emissions

Source or Project[b]	Isotope Emissions (Ci/yr)[a]				
	Pu-239/240	Am-241	U-233/234	U-235	U-238
Resuspension by Wind Erosion	4.8E-05	1.5E-05	2.2E-07	3.2E-08	1.5E-07
IHSS Group 700-7 Remediation	1.2E-05	1.4E-06	--	--	--
IHSS 118.1 Remediation	9.6E-10	5.3E-10	--	--	--
Original Landfill Radiological Contamination Surface Soil Removal	--	--	6.7E-07	1.6E-07	9.1E-06
Bowman's Pond Remediation	8.2E-10	2.0E-10	6.8E-10	3.0E-11	1.1E-09
B-Series Ponds Sediment Remediation[c]	1.4E-04	2.6E-05	--	--	--
903 Lip Area Soil Remediation[d]	1.7E-03	3.0E-04	--	--	--
Building 447 Demolition	--	--	7.8E-08	1.0E-08	7.1E-07
Building 774, Rooms 202, 203, and 210 Demolition	3.3E-08	3.9E-09	--	--	--
Building 771 Demolition	7.1E-06	8.7E-07	--	--	--
Building 964 Demolition	2.6E-06	3.1E-07	--	--	--
Building 883 C-Side Demolition	--	--	2.1E-08	1.8E-09	1.5E-07
Building 883 Annex Demolition	--	--	8.1E-08	6.7E-09	5.8E-07
Building 443 Culvert Removal	2.4E-07	2.8E-08	--	--	--
Tanker Loading at the 750 Pad	9.1E-07	1.1E-07	--	--	--
Building 374 Sludge Repackaging	7.3E-06	8.5E-07	--	--	--

[a] Emissions of all isotopes that could contribute greater than 10% of the potential EDE for a release point were estimated. The locations of the nonpoint release emission sources, except for wind resuspension areas and B-series pond remediation activities, are shown in Figure 3-1 of this report. Isopleths of surface soil contamination that contribute to wind resuspension of radionuclides were shown in Appendix D of the 2003 *Radionuclide Air Emissions Annual Report* (Kaiser-Hill, 2004).

[b] Emissions assumed to be uncontrolled.

[c] Project will continue into 2005. Total emissions over both years shown.

[d] Project was initiated in 2003 and concluded in 2004. Total emissions over both years shown.

Notes:

Am	=	Americium
Ci/yr	=	Curies per year, 1 Ci = 3.7×10^{10} Becquerel (Bq)
E#	=	$x10^{\#}$
EDE	=	Effective dose equivalent
Pu	=	Plutonium
U	=	Uranium

28

3.3.1 Nonpoint Source Descriptions

In calendar year 2004, nonpoint sources of radionuclide emissions at the Site included resuspension of contaminated soils by wind erosion and by mechanical disturbance due to excavation, handling, and vehicle traffic. Mechanical disturbance of contaminated soils was associated with:

- 903 Lip Area Remediation (which continued from 2003);
- IHSS Group 700-7 Remediation;
- IHSS 118.1 Remediation;
- Original Landfill Radiological Contamination Surface Soil Removal;
- Bowman's Pond Remediation;
- B-Series Ponds Sediment Remediation (which will continue into 2005); and
- Building 443 Area Culvert Removal.

Calendar year 2004 nonpoint sources also included the Buildings 447, 771, 774, 883 Annex, 883 C-side, and 964 demolition projects, tanker loading at the 750 Pad, and the repackaging of Building 371/374 sludge north of Tent 2 on the 750 Pad.

Structures demolished during 2004 also included the following buildings and trailers that were not radiologically contaminated above free release criteria. Therefore, no radionuclide emissions were calculated for these demolition projects:

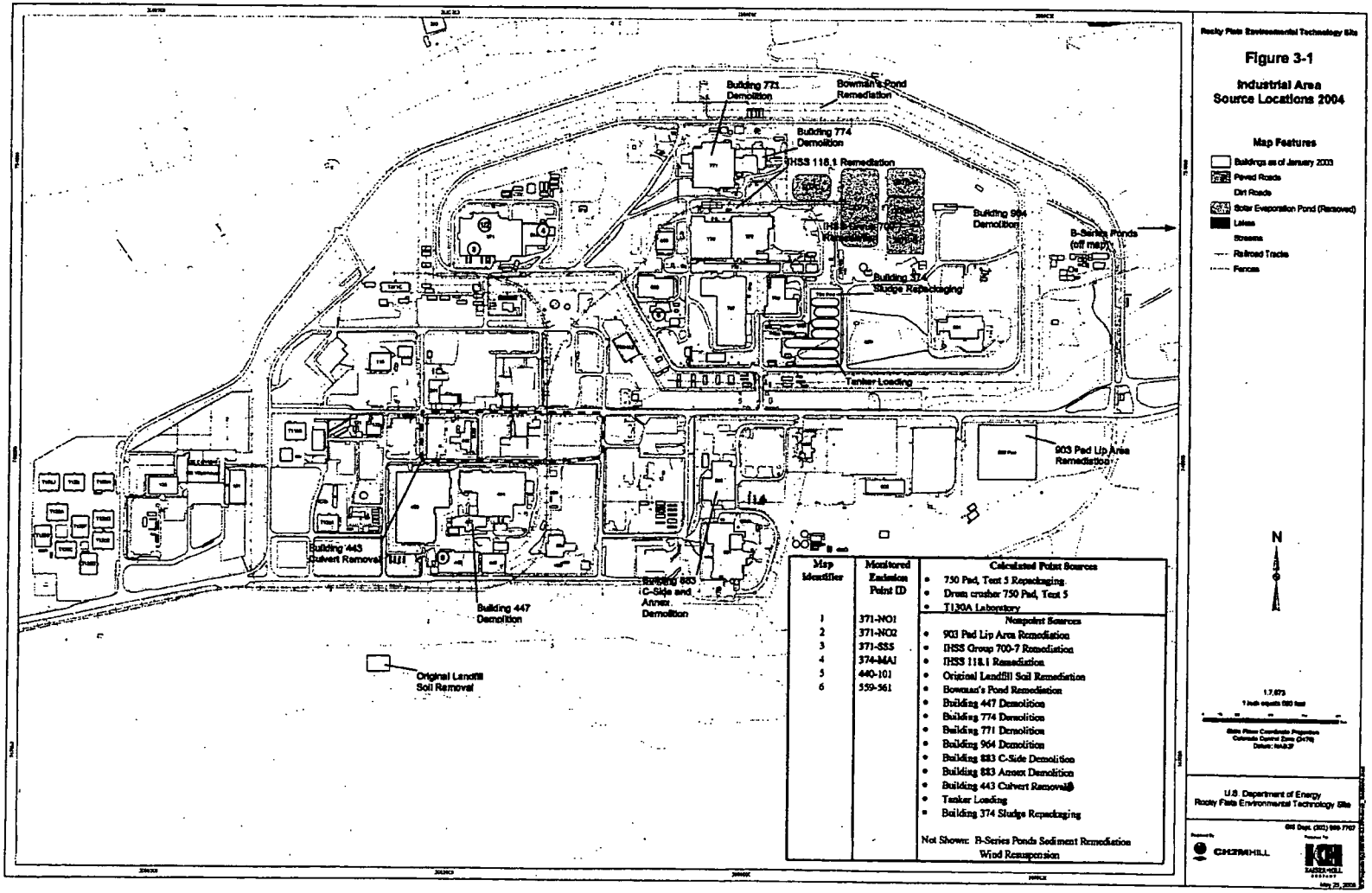
- Buildings 443, 223, 991, 952, 128, 131, 130, 715, 717, 710, 127, 881 Cluster, 705, 706, 903 A-A3, 124, 129, 448, 451, 750, 121, 122, 964, 115, 879, 903B, 995, 664, 906, 528, 302, 562, 564, and 708.
- Trailers 371A–F, 119B&C, 771A-C, 771G, 771L, 124A, 303D, 706A, 779A, 707B, 115B, 891B-C, 891T, 664A, and 130I.

3.3.2 Control Technology for Nonpoint Sources

Particulate emissions from significant earth-moving activities at the Site and from decommissioning activities were controlled by water spray or other dust suppression measures, with an estimated control efficiency of 50 percent. Fugitive dust control plans that specify the control measures to be used to minimize emissions of contaminated dust are developed for each project with the potential to generate significant radionuclide emissions from soil or debris handling, or from demolition activities. For calculation purposes, all projects listed in Table 3-3 were assumed to be uncontrolled, even though fugitive dust control measures were employed for most of the projects.

3.4 Release Locations

Figure 3-1 shows the location of various emission sources listed in Tables 3-1 through 3-3. Source areas for wind erosion of radionuclides were shown in Appendix D of the 2003 *Radionuclide Air Emissions Annual Report* (Kaiser-Hill, 2004).


Building 771 Demolition
Bowman's Pond Remediation
Building 774 Demolition
IHSS 118.1 Remediation
Building 964 Demolition
B-Series Ponds (off map)
Building 374 Sludge Repackaging
Tanker Loading
903 Pad Lip Area Remediation
Building 443 Culvert Removal
Building 447 Demolition
Building 883 C-Side and Annex Demolition
Original Landfill Soil Removal
Rocky Flats Environmental Technology Site
Figure 3-1
Industrial Area
Source Locations 2004
Map Features
Buildings as of January 2003
Paved Roads
Dirt Roads
Solar Evaporation Ponds (Removed)
Lakes
Streams
Railroad Tracks
Fences
N
U.S. Department of Energy
Rocky Flats Environmental Technology Site
Map Identifier
Monitored Emission Point ID
Calculated Point Sources
750 Pad, Tent 5 Repackaging
Drum crusher 750 Pad, Tent 5
T130A Laboratory
1 371-NO1
2 371-NO2
3 371-SSS
4 374-MAI
5 440-101
6 559-561
Nonpoint Sources
903 Pad Lip Area Remediation
IHSS Group 700-7 Remediation
IHSS 118.1 Remediation
Original Landfill Soil Remediation
Bowman's Pond Remediation
Building 447 Demolition
Building 774 Demolition
Building 771 Demolition
Building 964 Demolition
Building 883 C-Side Demolition
Building 883 Annex Demolition
Building 443 Culvert Removal
Tanker Loading
Building 374 Sludge Repackaging
Not Shown: B-Series Ponds Sediment Remediation
Wind Resuspension

4.0 COMPLIANCE ASSESSMENT

This section describes the compliance assessment performed for the Site for the 2004 calendar year.

4.1 Compliance Demonstration Based on Environmental Measurements

Historically, the Site demonstrated compliance with the annual 10-mrem public dose standard in 40 CFR 61, Subpart H, through measurement and dispersion modeling of measured point source emissions, and emission estimation and dispersion modeling of nonpoint and calculated point source emissions, to determine the dose to the most impacted off-Site resident. Beginning with calendar year 1998, the Site transitioned to an alternative compliance demonstration method based on environmental measurements, as allowed by 40 CFR 61.93(b)(5). The calendar year 2004 compliance assessment is based on the alternative method, which is described below.

4.1.1 Description of Compliance Sampling Network

The Site operates a network of high-volume, size-fractionating ambient air samplers located on and around the Site, and in nearby communities (the RAAMP network). The compliance sampling network consists of 14 of these samplers located along the Site perimeter. The compliance sampling network is shown in Figure 4-1, along with nearby businesses or residences (receptors).

The ambient air samplers continuously collect both fine and coarse particulate matter fractions on filters and removable impactor surfaces that are exchanged and analyzed on a monthly schedule. The samples are analyzed for the plutonium, americium, and uranium isotopes that represent most of the radioactive materials handled at or residing on the Site. These isotopes account for all materials that have the potential to contribute 10% or more of the dose to the public.

Residential and commercial development on and around the Site is reviewed on a quarterly basis. If new development or privatization projects warrant additional or revised sampler locations, EPA and CDPHE will be notified. Sampler installation will be scheduled so that samplers will be operational when the new residence or business is occupied. No development that warranted additional or revised sampler location occurred in calendar year 2004.

Following the transition to the alternative compliance demonstration method, effluent collection and measurement were discontinued for insignificant release points on Site and the ambient network is now used to verify low emissions from these locations, as required by Section 61.93(b)(4). Emissions from significant release points continued to be measured with the existing effluent sampling systems until the buildings entered active decommissioning or until the operations that exceeded the 0.1 mrem trigger ceased. As of the end of calendar year 2004, only a single significant release point remained active; all other release points previously sampled have either entered active decommissioning or the buildings have been demolished. When the single remaining effluent sampling location is shut down in the second quarter of calendar year 2005, effluent sampling will be permanently discontinued at the Site.

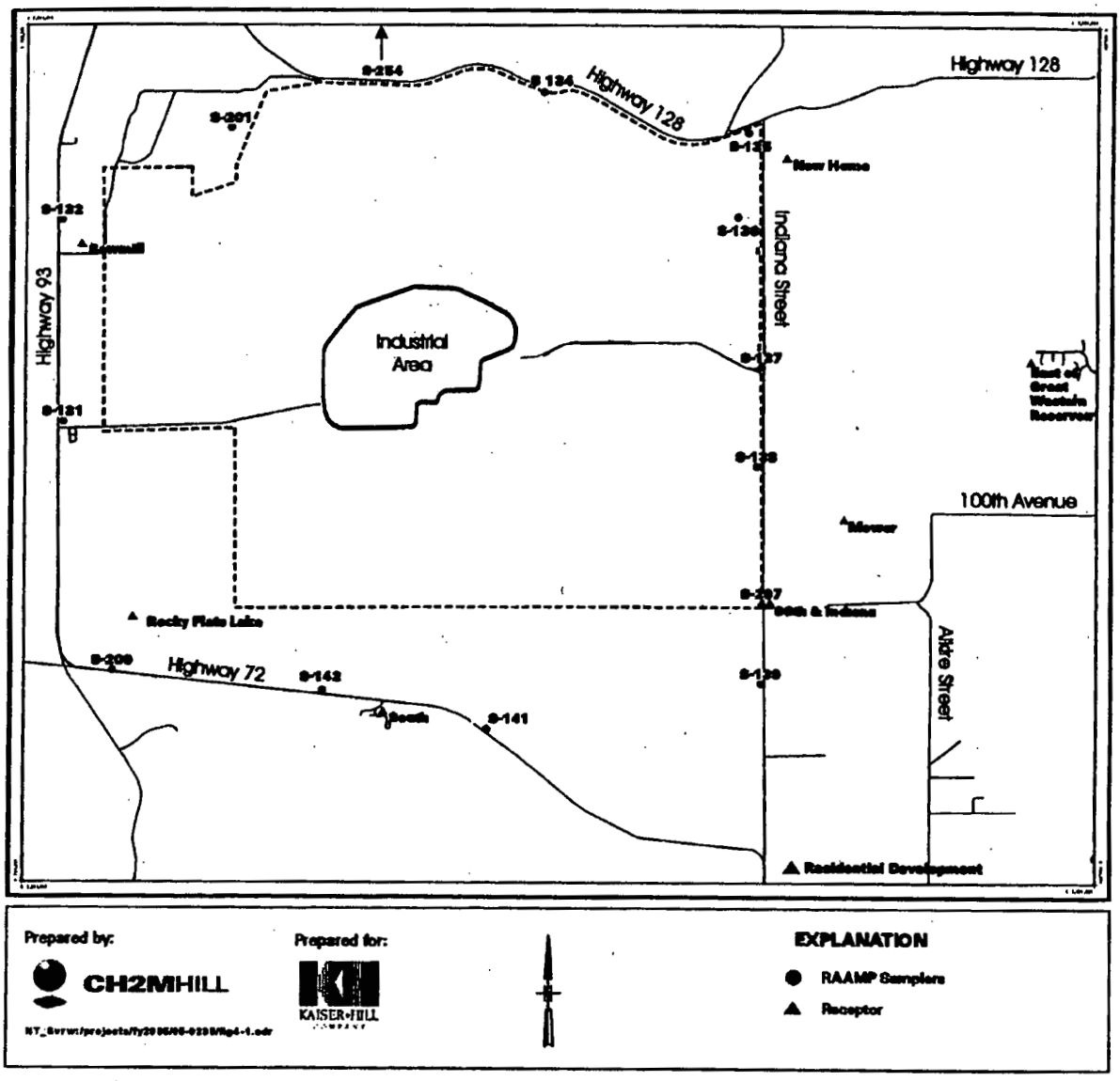


Figure 4-1. Receptor Locations and Nearby Samplers

4.1.2 Compliance Sampling Network Measurements for 2004

Filters from the compliance sampling network were generally exchanged monthly during 2004, then analyzed for Pu-239/240, Am-241, U-233/234, U-235, and U-238. (In a few cases, high dust loading required that filters be exchanged more often than monthly. When this was necessary, the filters were composited for the month by location and the composite sample was analyzed for the isotopes listed above.)

These isotopes accounted for all materials that had the potential to contribute 10% or more of the dose to the public. Annual average isotopic concentrations were calculated at each sampler from monthly isotopic concentration and sample volume data. The annual average isotopic concentrations for each compliance sampler are shown in Table 4-1.

A *fractional sum* was calculated for each sampler location by dividing each annual isotopic concentration by that isotope's corresponding *compliance level* as listed in Table 2 of Appendix E to 40 CFR 61, then summing the fractions. The fractional sums are also shown in Table 4-1.

4.2 Compliance Assessment Results

This section discusses the results of the compliance assessment for calendar year 2004.

4.2.1 Compliance Demonstration

As reported in Section 4.1 of this report, the maximum annual concentrations of Pu-239/240, Am-241, U-233/234, U-235, and U-238 measured at the compliance sampling network were compared to the compliance levels listed in Table 2 of Appendix E to 40 CFR 61. In each case, the maximum measured concentration of each isotope, as shown in Table 4-1, was less than 1% of the corresponding compliance level. In addition, the fractional sum of all isotopes at the *critical receptor* location (the sampler showing the highest concentrations in 2004) was determined to be 0.0156. (This corresponds to an annual dose of 0.156 mrem, or 1.56% of the 10-mrem standard.) The facility is in compliance when the annual concentration of each isotope is less than its corresponding Table 2 compliance level and when the fractional sum of all isotopes is less than 1.

Figure 4-2 shows data from the 2004 compliance sampling network at all locations. The data are presented as percentages of the compliance level for each isotope; the total height of each bar in Figure 4-2 represents the fractional sum expressed as a percent of the allowable sum (percent of 1). Data are presented for each sampler, beginning with S-131 at the west gate of the Site, and continuing around the Site perimeter in a clockwise direction. Sampler locations are shown in Figure 4-1.

In 2004, the maximum measured radionuclide levels occurred to the north of the Site, at sampler S-254. Sampler S-254 is located immediately adjacent to an unpaved road that has seen increasing traffic volumes in the past few years due to expanded commercial development at one end of the road, leading to its use as a "short cut" to the Superior area. This is the same sampler that had the highest measured radionuclide concentrations in 2003.

Table 4-1. Annual Average Isotopic Concentrations at Compliance Sampling Network Locations

Sampler	Pu-239/240 (Ci/m^3)	Am-241 (Ci/m^3)	U-233/234 (Ci/m^3)	U-235 (Ci/m^3)	U-238 (Ci/m^3)	Fractional Sum
S-131	1.22E-18	1.30E-18	2.77E-17	1.33E-18	2.73E-17	0.0087
S-132	6.25E-19	3.39E-19	3.50E-17	1.90E-18	3.40E-17	0.0098
S-134	5.03E-19	3.42E-19	1.28E-17	5.25E-19	1.35E-17	0.0039
S-135	4.87E-19	2.78E-19	1.74E-17	5.95E-19	1.87E-17	0.0052
S-136	9.57E-19	2.43E-19	1.32E-17	5.29E-19	1.42E-17	0.0043
S-137	2.30E-18	6.55E-19	1.78E-17	1.08E-18	1.72E-17	0.0062
S-138	2.76E-18	4.24E-19	1.85E-17	5.22E-19	1.74E-17	0.0064
S-139	4.97E-19	1.34E-19	2.26E-17	7.88E-19	2.16E-17	0.0062
S-141	6.74E-19	1.46E-19	1.69E-17	1.01E-18	1.72E-17	0.0050
S-142	4.12E-19	2.71E-19	1.64E-17	7.77E-19	1.65E-17	0.0048
S-201	5.05E-19	1.56E-19	1.83E-17	5.94E-19	1.84E-17	0.0052
S-207	1.52E-18	3.52E-19	2.27E-17	6.56E-19	2.21E-17	0.0069
S-209	7.61E-19	1.75E-19	1.49E-17	9.09E-19	1.62E-17	0.0046
S-254	1.61E-19	1.47E-19	5.79E-17	2.62E-18	5.73E-17	**0.0156**
Compliance Level (Ci/m^3)[a]	**2.0E-15**	**1.9E-15**	**7.1/7.7E-15**	**7.1E-15**	**8.3E-15**	**1**

[a] Compliance levels are listed for each isotope in Table 2 of Appendix E to 40 CFR 61.

Notes:

Am = Americium
Ci/m^3 = Curies per cubic meter; 1 Ci = 3.7×10^{10} Becquerel (Bq)
E# = $\times 10^{\#}$
Pu = Plutonium
U = Uranium

Examination of the isotopic data presented in Table 4-1 and Figure 4-2 shows that the higher overall radionuclide levels (fractional sum) at S-254, relative to other samplers in the compliance sampling network, were primarily due to higher levels of U-233/234 and U-238. The ratio of U-233/234 to U-238 activities at S-254 (and at other compliance samplers) was close to 1:1, which is characteristic of naturally occurring uranium. (In contrast, depleted or enriched uranium that might be emitted from on-Site sources would show different isotopic ratios.) As noted previously, S-254 is located in an area that experienced elevated dust levels in 2004 due to traffic on the immediately adjacent unpaved road. The soils surrounding Rocky Flats contain naturally occurring uranium, which likely explains the elevated activities at this sampler. Figure 4-3 shows the isotopic breakdown at S-254 as a percentage of the total fractional sum at that location; over 96% of the fractional sum is due to U-233/234 and U-238.

S-254 had the highest concentrations of U-233/234 and U-238 of any compliance sampler from May through October 2004, months when road dust is more likely since the surface would be often frozen or wet during winter months. If U-234 and U-238 concentrations at this sampler are compared to those measured in 2003 and 2002, it is apparent that concentrations increased in 2003 and have remained elevated since then, corresponding to an apparent ongoing change in road usage and traffic volumes. U-234 and U-238

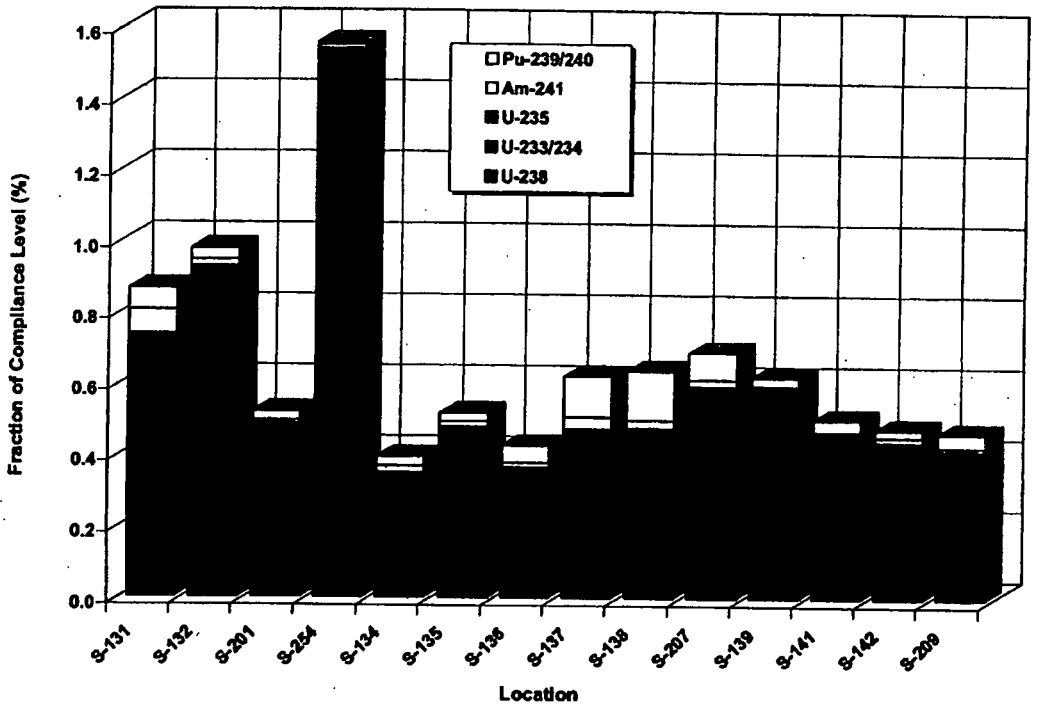


Figure 4-2. Environmental Measurements of Airborne Radionuclides in 2004

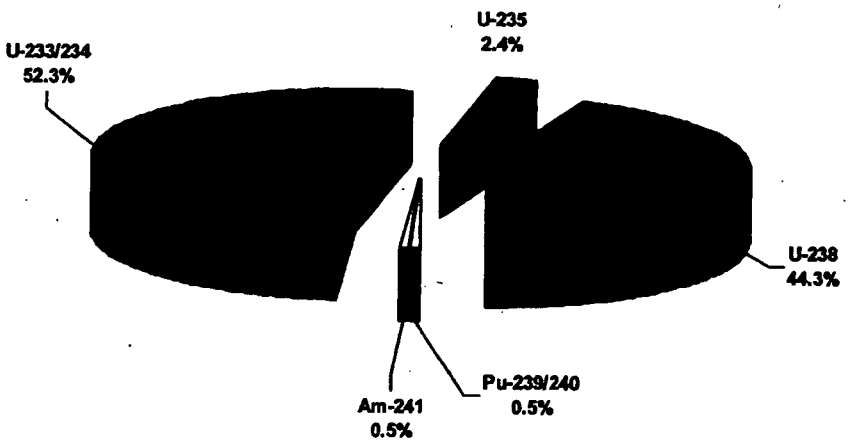


Figure 4-3. Isotopic Contribution to the Fractional Sum at the Critical Receptor

35

concentrations in 2003 were 190% and 181% of those measured at this sampler in 2002, respectively, while 2004 concentrations were 128% and 124% of the 2002 "baseline."

The increase in measured U-234 and U-238 concentrations at this particular sampler is striking in contrast to other compliance samplers, where U-234 and U-238 concentrations have decreased over the same time period, most likely corresponding to variations in precipitation. Only 28.2 centimeters (cm) of precipitation were measured at the Site in 2002 and the area was in a severe drought. Moisture increased in 2003 to 35.2 cm, while 2004 was a relatively wet year at 59.7 cm. Averaged across all compliance samplers except S-254, U-234 and U-238 concentrations in 2004 were around 75% of levels measured in 2003, and little more than half (56%) of concentrations measured in 2002.

In spite of this decrease in U-234 and U-238 concentrations, naturally occurring uranium isotopes appear to have dominated airborne radionuclide levels not only at S-254 but at the other compliance samplers as well in 2004. The sum of U-233/234 and U-238 activity ranged from 74% to over 96% of the fractional sum at all compliance samplers in 2004.

Figure 4-4 shows the measured levels of Pu-239/240 and Am-241 at the compliance sampling network locations, also presented as percentages of the compliance level for each isotope. These two isotopes are characteristic of the weapons-grade plutonium that was used at the Site.

As in most previous years, elevated Pu-239/240 and Am-241 concentrations were apparent at several of the samplers located along the eastern boundary of the Site (relative to concentrations at other compliance network samplers) in 2004. Based on annual average wind patterns, these samplers (S-136, S-137, S-138, and S-207) are generally downwind of Site activities, including dust generating activities at the 903 Pad Lip Area, B-series ponds, and other contamination areas that were remediated in 2004. Pu-239/240 and Am-241 were also somewhat elevated at S-131, which is located at the west gate. Elevated concentrations at this location could result from heavy use of this area by trucks hauling demolition rubble and other waste, or could simply reflect traffic loading. Pu-239/240 and especially Am-241 concentrations have been elevated at this sampler at times previously, when no relationship to Site activity could be discerned, and have appeared to be correlated with dusty conditions.

The fractional sum information for calendar year 2004 for the critical receptor can be compared with the 10-mrem dose limit and with data from prior years. As noted previously, the fractional sum at the critical receptor location in 2004 was 0.0156. The fractional sum can be directly related to the allowable dose limit of 10 mrem in 40 CFR 61, Subpart H, the fractional-sum limit being 1. As a result, the maximum dose recorded at the compliance sampling network in 2004 was nearly two orders of magnitude below the 10-mrem limit and more than 96% of the dose was due to uranium isotopes that are largely naturally occurring in the Site environment. For comparison, the fractional sum at the critical receptor was 0.0252 in 2003, 0.0156 in 2002, 0.0128 in 2001, 0.0130 in 2000, 0.0145 in 1999, 0.0141 in 1998, and 0.0128 in 1997.

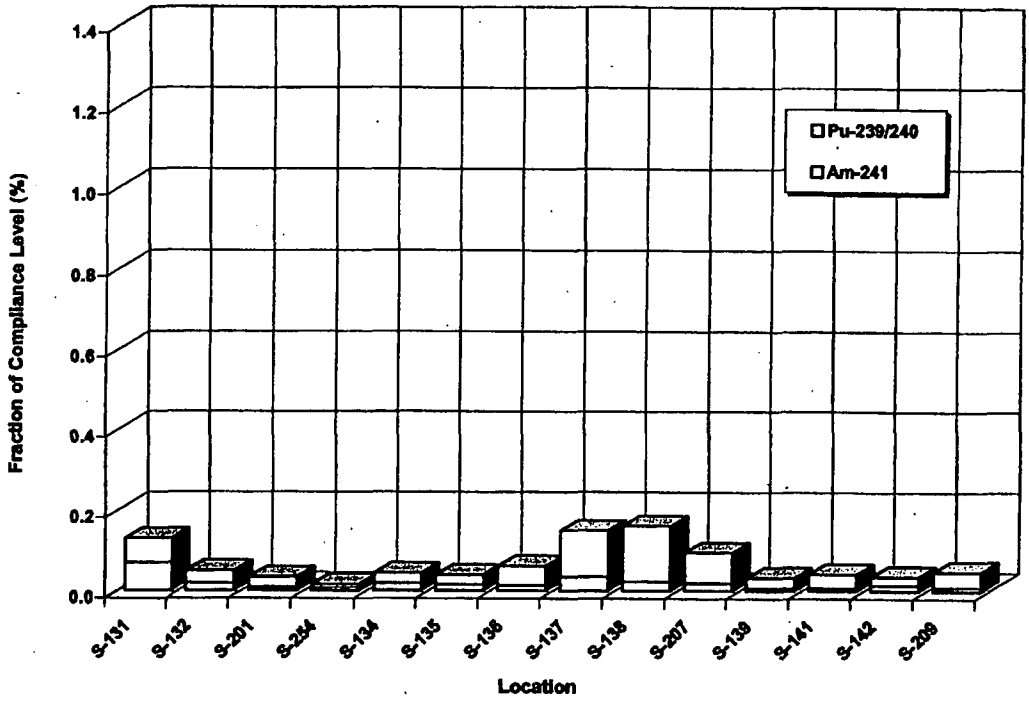


Figure 4-4. Environmental Measurements of Pu-239/240 and Am-241 in 2004

4.2.2 Statement of Compliance Status

Compliance with the 10-mrem standard has been determined by comparing environmental radionuclide air concentration measurements at the critical receptor location with the "Concentration Levels for Environmental Compliance" listed in Table 2 of Appendix E to 40 CFR 61. Compliance is demonstrated when each measured radionuclide air concentration is less than its corresponding compliance level in Table 2 and when the fractional sum of all radionuclides is less than 1. For 2004, each measured radionuclide air concentration was less than 1% of its corresponding compliance level and the fractional sum of all radionuclides was less than 2% of the allowable level at the critical receptor (the sampler with the highest fractional sum). The Site was in compliance with the 10-mrem standard during 2004.

4.3 Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment. (See 18 USC 1001.)

Frazer R. Lockhart	David C. Shelton
Manager	Vice President
Rocky Flats Project Office	Environmental Systems and Stewardship
US Department of Energy	Kaiser-Hill Company, LLC
Signature Date	Signature Date

5.0 SUPPLEMENTAL INFORMATION

The following information is provided pursuant to DOE guidance or EPA request and is not required by 40 CFR 61, Subpart H, reporting requirements.

- **Calendar year 2004 collective dose:** DOE facilities such as the Site are required to estimate the collective dose to the surrounding population on an annual basis by DOE Order 5400.5, *Radiation Protection of the Public and the* Environment. While not a requirement of 40 CFR 61, Subpart H, the collective dose calculation for the air pathway has typically been reported in this annual report. Collective dose is defined as the sum of the EDEs of all individuals in an exposed population within an 80-km radius of the center of the Site (DOE, 1990).

  For calendar year 2004, the population distributions that form the basis of the collective dose calculation were updated. Estimated population growth figures for 2000 to 2004 were obtained for the counties located within 80 km of the Site from the State of Colorado, Department of Local Affairs, Demography Section. Similar estimates were obtained for counties in the metropolitan Denver area from the Denver Regional Council of Governments (DRCOG). Where two growth projections were obtained for a single county, the projections were averaged. Percentage growth estimates were applied to 2000 census data for each census tract within 80 km of the Site to obtain 2004 population values for modeling.

  The collective dose was calculated with CAP88-PC, as described in Appendix D. The collective dose for calendar year 2004 was 8.13 person-rem (0.0813 person-Sv).

- **Other radionuclide regulations:** 40 CFR 61, Subparts T and Q (CAQCC Regulation No. 8, Part A, Subparts T and Q) are not applicable to this Site. Subparts T and Q contain standards for radon emissions from specific facilities.

- **Unplanned releases:** There were no unplanned releases of radionuclides to the atmosphere from the Site during 2004.

- **Coarse and fine particulate matter fractions:** As described previously, the compliance network samplers collect both fine and coarse particulate matter on filters and removable impactor surfaces. The fine fraction contains smaller particles that could reach and be retained in the lung, while the larger coarse fraction particles are more likely to be removed from the airstream before reaching the lungs. As a result, radionuclides in the fine fraction of measured particulate matter have a higher health risk than coarser particles.

  To determine how much of the annual radionuclide activity measured at the compliance sampling network in 2004 is due to fine particles, the fine and coarse fraction data were examined for the critical receptor location, where the maximum calculated dose occurred (sampler S-254). Monthly concentrations at S-254 for all radionuclides measured (sum of Am-241, Pu-239/240, U-233/234, U-235, and U-238) ranged from 19% to 49% fine particles, with an average of 32% in the fine fraction. Am-241 and Pu-239/240 ranged from 0% to 100% each in the fine fraction, averaging 31% and 10% fine particles, respectively. U-233/234 and

U-238 were more consistent, with the fine fraction varying between 32% and 62% for U-233/234 (averaging 43%) and between 34% and 57% for U-238 (averaging 45%).

Airborne radionuclide concentrations at S-138 were also examined. S-138 showed the highest concentrations of Am-241 and Pu-239/240 at any of the compliance sampling network locations in 2004. Am-241 concentrations ranged from 0% to 100% in the fine fraction by month (averaging 53%); Pu-239/240 concentrations also ranged from 0% to 100% in the fine fraction by month (averaging 57%). U-233/234 concentrations ranged from 9% to 81% fine particles (averaging 55%), while U-238 concentrations ranged from 28% to 69% fine particles (averaging 53%). The sum of all measured radionuclides spanned the range from 15% to 76% in the fine fraction at S-138 in 2004, averaging 49% fine particles.

6.0 REFERENCES CITED

DOE, 1990. Order 5400.5, *Radiation Protection of the Public and the Environment.*

DOE, 1996. *Radionuclide Air Emissions Annual Report for Calendar Year 1995.* Rocky Flats Field Office, Golden, CO. June.

DOE, 1997. *Proposal to Use Environmental Sampling for Demonstrating Compliance with 40 CFR 61, Subpart H.* Rocky Flats Field Office, Golden, CO. July.

EPA, 1972. *Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States.* Office of Air Programs, Research Triangle Park, NC. January.

EPA, 1991. *Guidance on Implementing the Radionuclide NESHAPS.* Office of Radiation Programs, Washington, D.C. July.

EPA, 1995. *Compilation of Air Pollutant Emission Factors.* Volumes I and II. Office of Air Quality Planning and Standards, Research Triangle Park, NC. January.

Kaiser-Hill Company, LLC, 2002. *Building 776/777 Air Modeling Technical Document.* Golden, CO.

Kaiser-Hill Company, LLC, 2003. "Auditable Safety Analysis, Building T130A, Analytical Services Modular Laboratory." Golden, CO. April 15.

Kaiser-Hill Company, LLC, 2004. *Radionuclide Air Emissions Annual Report for Calendar Year 2003.* Golden, CO.

Novick, V.J., P.J. Higgins, B. Dierkschiede, C. Abrahamson, W.B. Richardson, P.R. Monson, and P.G. Ellison, 1985. "Efficiency and Mass Loading Characteristics of a Typical HEPA Filter Media Material" in *21st DOE/NRC Nuclear Air Cleaning Conference Proceedings.*

Roberts, Rick (Kaiser-Hill Company, LLC), 1998. Personal Communication. June 16.

APPENDIX A

RADIOACTIVE MATERIALS ASSOCIATED WITH ROCKY FLATS

RADIOACTIVE MATERIALS ASSOCIATED WITH ROCKY FLATS CALENDAR YEAR 2004

A. RADIOACTIVE MATERIALS PRESENT IN KILOGRAM QUANTITIES

1. Enriched Uranium

Common Name: Oralloy
Normal Isotopic Composition: >90% U-235

2. Depleted Uranium

Common Names: Tuballoy, D-38, U-238
Normal Isotopic Composition: <0.71% U-235

3. Natural Uranium (Thorium and Uranium-233)

Rocky Flats has historically had the capability to handle these in kilogram quantities and some of these materials have been handled in the past.

B. RADIOACTIVE MATERIALS PRESENT IN GRAM QUANTITIES (<1 kilogram)

Plutonium-239,-240

C. RADIOISOTOPES USED AT ROCKY FLATS AS ACCOUNTABLE AND/OR TRACEABLE/NONACCOUNTABLE SOURCES

1. Traceable (Nonaccountable) Sources

Sealed solids < Appendix E values[1]
Plated solids < Appendix E values
Liquids < 10^{-3} µCi

Americium	(Am-241)
Barium	(Ba-133)
Californium	(Cf-252)
Carbon	(C-14)
Cesium	(Cs-137)
Chlorine	(Cl-36)
Cobalt	(Co-57, -60)
Europium	(Eu-154)
Gadolinium	(Gd-148)
Plutonium	(Pu-238, -239)
Radium	(Ra-226)
Strontium	(Sr-90)
Thorium	(Th-230)
Uranium	(U-234, -235,-238)

[1] Accountability is determined by 10 CFR 835, Appendix E. Sealed radioactive sources with activities equal to or greater than Appendix E values are accountable. The activities are individual for each isotope and are not all equal in value.

APPENDIX B

EFFLUENT RELEASE POINTS
CALENDAR YEAR 2004

Effluent Release Points
Calendar Year 2004[a]

Building/ Location	Release Points	Subpart H Category	Notes
Release Points Sampled Throughout 2004			
440-101	1	Significant	Scheduled for shut down and demolition in 2005
Release Points Sampled During Part of 2004			
371-N01	1	Significant	Shut down 7/6/04 due to active decommissioning
371-N02	1	Significant	Shut down 7/6/04 due to active decommissioning
371-SSS	1	Significant	Shut down 7/6/04 due to active decommissioning
374-MAI	1	Significant	Shut down 7/6/04 due to active decommissioning
559-561	1	Significant	Shut down 6/22/04 due to active decommissioning

[a] Formerly monitored release points where sampling has been permanently discontinued were listed in prior reports.

APPENDIX C

EFFLUENT INFORMATION SYSTEM (EIS) DATA
2004

Summary Table For The EIS/ODIS Database[a,b]
2004-Release (Ci)

02_ODIS Location	ODIS Location Code	N	Effluent Volume (m^3)	Plutonium 239/240	Americium 241	Uranium 233/234	Uranium 235	Uranium 238
371-N01		6	1.269E+08	3.361E-09	2.159E-09	8.619E-10	6.813E-10	1.357E-10
371-N02		6	1.251E+08	7.730E-09	2.676E-09	6.248E-09	1.949E-09	2.155E-09
371-SSS	AFGHC371002	6	1.786E+08	2.546E-09	6.202E-10	2.596E-09	1.825E-10	2.501E-09
374-MAI	AFGHJ374001	6	1.500E+08	8.275E-10	1.810E-09	3.704E-09	1.931E-09	4.875E-09
440-101		12	6.732E+07	8.174E-10	2.192E-10	1.285E-09	6.257E-10	1.224E-09
559-561	AFGHA559001	6	2.352E+08	1.199E-09	6.143E-10	6.776E-09	3.880E-09	2.779E-09
RFETS		30	8.829E+08	1.648E-08	8.099E-09	2.147E-08	9.249E-09	1.367E-08

[a] No longer report Pu-238.

[b] Many locations have been removed from this report, as sampling no longer was required or the building no longer exists.

Notes:

Ci	= Curies
EIS	= Effluent Information System
m^3	= Cubic meters
N	= Number of samples analyzed
ODIS	= On-Site Discharge Information System
RFETS	= Rocky Flats Environmental Technology Site

MODELING SUMMARY

Model Description and Use

CAP88-PC is a dispersion and dose model that has historically been used at the Site for calculating EDE to both individual members of the public and to the surrounding population within 80 km. The model simulates the dispersion of airborne radionuclide emissions from point and nonpoint (termed "area") sources to user-specified receptor locations, then calculates an annual, multipathway EDE for a person living or working at each specified receptor location. When combined with population distribution information, CAP88 estimates the collective dose to the surrounding population.

Summary of Model Input Data

The model accounts for dose received from Site emissions through inhalation and ingestion of radionuclides in air and deposited on the ground surface. To simulate pollutant dispersion and calculate dose, the model requires the following types of input data:

- Distance and direction from emission sources to receptor locations.
- Source release characteristics, including stack locations, stack heights, exhaust gas velocities and temperatures, the size of each stack or vent opening for point sources, and the size and location of each area source.
- The amount of each radioactive isotope released from each source.
- Meteorological data including the annual distribution of wind speed, wind direction, and atmospheric stability at the Site, and annual precipitation and temperature information. The model also requires information about the average height of regional temperature inversions (mixing height).
- Agricultural data used in calculating radionuclide ingestion rates including the location, distribution, and utilization of local and regional sources of meat, milk, and vegetables.
- Miscellaneous data regarding the size and solubility of the particles emitted.

To calculate the calendar year 2004 collective dose, Site emissions (sum of all emissions shown in Tables 3-1, 3-2, and 3-3, by isotope) were modeled from a single area source located at the center of the Site. The source was assumed to have an area of 5.3×10^6 square meters (m^2) (about 20% of the total Site area), release height of 0.0 m, and no momentum plume rise (exit velocity of 0.0 meters per second [m/s]). These release characteristics were appropriate for the major source of radionuclide emissions in calendar year 2004, which was resuspension of contaminated soil and dust from wind and from mechanical disturbance during demolition and remediation activities.

Meteorological data for calendar year 2004 were collected from the NREL tower located approximately one mile northwest of the former RFETS meteorological tower. A joint frequency distribution of wind speed, wind direction, and stability was processed for

input to CAP88-PC. A "wind rose" graphic representation of the meteorological data is shown in Appendix E.

Annual precipitation and temperature data collected on Site for 2004 show:

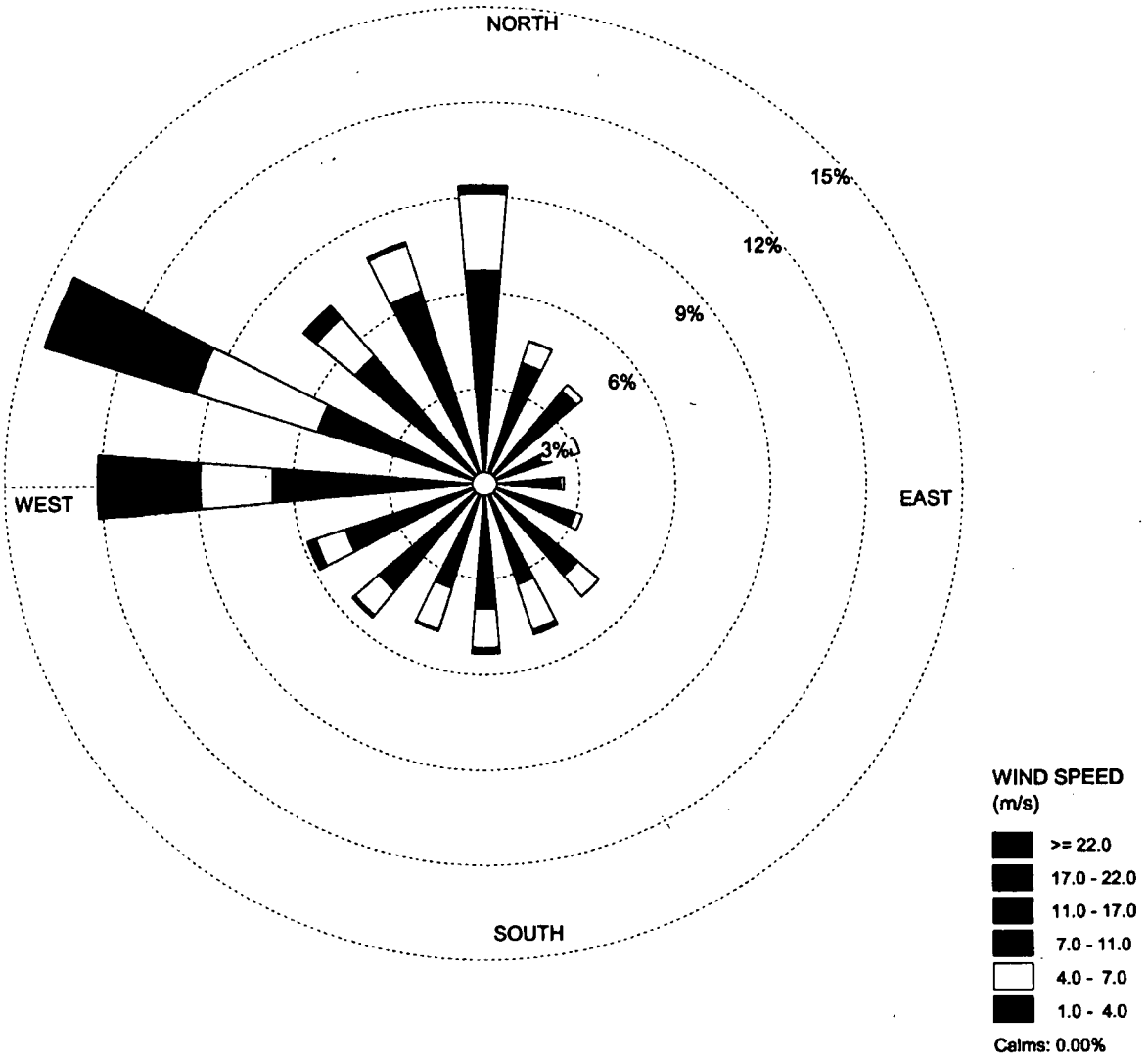
- Total precipitation in 2004: 59.7 cm; and
- Annual average temperature: 9.63°C.

An average mixing height for the Denver, Colorado, area of 1,405 m was used in the model (EPA, 1972).

The CAP88-PC model calculated EDEs over a polar coordinate receptor grid. The grid consisted of 16 compass sectors and 12 distances from the center of the Site: 2 km, 3 km, 6 km, 10 km, 15 km, 20 km, 24.5 km, 29.5 km, 39 km, 49 km, 64.5 km, and 80 km. CAP88-PC estimates an EDE at the midpoint of each grid cell, then multiplies each EDE by the population within the grid cell to calculate collective dose. Population data for the 2000 census were obtained, organized by census tract, and each whole or partial census tract within 80 km of the Site was assigned to a grid cell. The 2000 census data were scaled up for 2004 using growth estimates by county obtained from the State of Colorado, Department of Local Affairs, Demography Section, and DRCOG.

Model default values were used for the median aerodynamic diameter (1.0 micrometers) and solubility class. Urban agricultural data were used in the model. Default values were also used cattle density and for the land fraction cultivated for vegetable crops.

The total collective dose was calculated as the sum of the contributions from Pu-239/240, Am-241, U-233/234, U-235, and U-238.



Rocky Flats Environmental Technology Site
2004 Wind Rose